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Private Provision of Rural Infrastructure Services: Competing for Subsidies

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Abstract Market-oriented reforms of infrastructure in developing countries tend to focus primarily on commercially viable services in urban areas. Nevertheless, an increasing number of countries are beginning to experiment with extending the market paradigm to infrastructure services in rural areas that are often less attractive in commercial terms. In these cases, subsidies are used to close the gap between market requirements and development needs, and are increasingly determined and allocated on a competitive basis. The authors discuss the conditions under which competition among firms for such subsidies –successfully used in the telecommunications sector in a number of middle-income countries–could also be applied to electricity, water and sanitation and transportation services in lower-income countries.

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Three billion people live in rural areas worldwide and many lack communication, electricity, water, sanitation, and transportation services that are deemed essential for economic development and directly impact the quality of life. Monopoly provision, in most countries by the public sector, often leads to high investment and running costs, weak operation and maintenance, and limited responsiveness to local needs. Market distortions, government intervention, and hidden subsidies fail to promote efficient use of resources to meet social objectives, effectively target the poor, account for costs and benefits, or reduce dependence on subsidies.[1]

Market-oriented economic reforms have opened the way to more effective solutions for infrastructure services based on private sector provision, cost recovery through tariffs, increasingly competitive markets, and regulation where sufficient competition does not materialize. These reforms aim at accelerating service growth and innovation, making production more efficient, and increasing responsiveness to differing user needs and payment capabilities.

Gaps typically remain, however, between what service providers are prepared to do solely on commercial grounds and what governments consider necessary from broader development perspectives. Many rural areas and, to a lesser extent, low-income urban areas, continue to be excluded.

Subsidies may be justified to narrow these gaps. Loosely speaking, a subsidy exists when the costs incurred in supplying a service are not fully recovered from the revenues raised by selling this service, the difference being met by other customers in the same or related industries or by governments (Waddams Price 2000). The economic rationale for subsidy is based on the existence of consumption and production externalities, network externalities, and scale economies. Also, access to these services at affordable prices is considered essential to enable the rural population to participate equitably and effectively in a modern society (Serra 2000).[2]

Rural subsidy practices

In the context of market-oriented economic policies, subsidies for rural infrastructure services aim at developing sustainable markets for the private provision of these services. Subsidies are designed to turn socially desirable investments that are not profitable by themselves into commercially viable undertakings. Projects that are not demonstrably good for society at large or are unlikely to ever stand on their own do not justify subsidy support and are seldom undertaken.[3]

Good subsidy practice commits all participants to contribute to financing the provision of services:

- Service providers invest and risk their own resources to set up the facilities and provide the services during a given time under specified conditions.
- Government subsidies help service providers meet some investment and start-up costs. Subsidies are designed to reduce access barriers to which low-income groups are especially sensitive, such as initial connection, equipment, or installation charges.
- Customers pay for the use of services at least as much as is needed to meet operating and maintenance costs. Where domestic installations are involved, customers are also required to pay part of the investment cost, as a confirmation of economic demand for service and commitment to pay for service use. Consumption is subsidized only exceptionally and limited to small amounts of service regarded as essential.

The design of subsidies is closely tied to the available service delivery mechanisms. Subsidies are channeled through the service supply chain in ways that aim at being neutral with respect to competition among service providers, service alternatives, and technologies.

Competing for rural subsidies

Subsidies for rural infrastructure services are increasingly being determined and allocated through competition. This paper focuses on competition among private firms for subsidies to provide the services. Other forms of competition for subsidies include competition among projects proposed by communities or firms, competition among regional governments for central funds, and competition among sectors for a share of these funds. Implicit in all modalities is competition among technologies and business models to deliver the services.

Competition among firms for subsidies to provide infrastructure services in rural areas was pioneered by Chile in the mid-1990s in telecommunications (Wellenius 2002). Compared with traditional public sector funding, this approach resulted in lower subsidies, mobilization of substantial private investment, and enhanced transparency. Since then it has become a recognized good practice in telecommunications and has started to spread among upper-middle income countries and services that appeal most to private investors (telecommunications, electricity) and to lower-income countries and less attractive services (water and sanitation, transportation).

The emerging practice of competition among firms for subsidies comprises the following main steps:

- The government defines the broad objectives, target population, and levels of funding of the subsidy program. It also establishes key service conditions such as types of services to be provided, quality standards, maximum retail prices, and duration of service commitments.
- Specific service needs and choices are primarily identified by prospective beneficiaries and communities. Economic and technical analysis is used to select and prioritize projects that are likely to be desirable from the viewpoint of the economy at large but not commercially viable on their own, and to determine the maximum subsidy justified for each project.[4]
- Private firms submit competitive bids for these projects. Subject to meeting service conditions and complying with rules that apply to all providers, bidders are free to develop their business strategies including choice of technology.

- Subsidies are awarded to the bidders that require the lowest one-time subsidies. Alternatively, bids are invited for fixed subsidies and awarded against other quantifiable service measures, such as the lowest price to end users or the fastest roll-out of service.
- Subsidies are paid in full or in installments, linked to implementation of investments and start of service.
- Service providers own the facilities and bear all construction and commercial risks. No additional subsidies are available downstream for the same services.
- The government monitors and enforces service quality and pricing standards, protects users against arbitrary changes of service, and provides investors with stable rules of the game.

Telecommunications

Rural telecommunications subsidy programs aim at having payphones within reach of most rural inhabitants.[5] Payphones use coins, tokens, or pre-paid cards, or have attendants that facilitate use and collect payment. Attendants and informal messaging services enable incoming calls, which can account for a substantial proportion of traffic and operating revenues. A growing number of governments are also trying to extend public access to the Internet and other information and communication technologies (ICTs) and services, typically through multi-purpose communication centers (telecenters) in towns that are within reach of large rural populations. Subsidizing the provision of a telephone, fax, or Internet connection in every rural home, farm, or business would in most developing countries be an unrealistic policy target.[6]

Rural payphone service is provided by public telecommunications operating companies, existing or newly set up for this specific business, by extending urban fixed telephone networks (mainly using radio, cable, and small satellite terminals) and more recently also by extending mobile phone networks.[7] Wide population coverage of mobile service, typically up to 90 percent of the population, is also enabling new payphone service delivery modes, such as the sale of calls from mobile phones to the public by small entrepreneurs (e.g. India, Nepal, Cambodia) and business organizations (e.g. Bangladesh, Uganda) (Lawson 2000). Pre-paid mobile phones also reach low-income users that were excluded from subscribing to fixed telephones even if available, thus extending access to individual phone connections in urban and some rural areas (Oestmann 2003). Well-off rural inhabitants can self-select out of exclusion by subscribing to costlier mobile satellite services or installing private point-to-point radio links. Telecenters are still largely experimental government or aid projects but sustainable business models are emerging (Wellenius 2003).

Table1: Selected Rural Payphone Programs in Latin America, 1995-2000

	Chile	Colombia	Guatemala	Peru
Country data				
GDP per capita (1995), $	4,710	2,040	1,380	2,440
Rural population as % of total (1995)	15	27	59	28
Main telephones per 100 inhabitants (1996)	16	12	3	6
Program design				
Summary	200 projects. 7 bidding rounds, 1995-2000	7 regional projects. Single bidding round, 1999	17 provincial projects. Bids awarded until 7/2000	7 regional projects. 3 bidding rounds, 1998-2000
Population of localities to be served	>60	>250		>300
Service obligation, years	10	10	5	20
Price regulation	yes	yes	no	yes
Exclusive operating rights	no	no	no	no
Sources of subsidy funds	government budget	levy on operators, fees	spectrum license fees	levy on operators, fees
Subsidy payout after service begins	in full	installments (18 months)	installments (18 months)	installments (5 years)
Program results				
Localities served	6,059	7,415	1,598	4,420
population, million	2.2	3.7	1.3	1.6
% of total rural population	>90	35	20	24
Regional call charge per minute, US cents	11	14		6
Annual revenue per payphone, $ (est.)	1,400	1,300		1,900
Subsidy awarded, $ million	22	34	7	42
per locality, $	3,600	4,600	4,400	9,500
per inhabitant in localities served, $	10	9	5	26
as % of maximum subsidy available	60	45	78	37
as % of total telecommunications revenue	0.3	1		1
Private investment per $ of subsidy, $	6		3	2
Localities per project	30	1,200	94	630
Number of bidders per round	3-5	2-7	2-5	2-5

Sources: Authors' compilation from Izaguirre 1999, Cannock.2001, and ITU 1998

Competition among firms for subsidies is by now a well-established tool used to extend payphones to rural areas in middle-income countries. Table 1 summarizes the experience of Chile, Colombia, Guatemala, and Peru. In all these countries, basic voice communication has become accessible to large segments of the rural population previously excluded. Investments have been mainly financed by the private sector

catalyzed by relatively small amounts of public subsidy, typically of the order of $5,000 per locality or $10 per inhabitant.[8] Subsidies per locality and per inhabitant, however, increase rapidly as the program reaches out to the more distant and smaller places.[9] Revenues generated from outgoing calls, typically around $1,500 per year for these countries, meet operating and maintenance expenses but do not recover investments. Access charges paid to rural operators for completing calls originated elsewhere provide substantial additional revenue when priced to reflect the higher costs of service in rural areas. None of the providers was granted exclusive operating rights, and in most cases the maximum call charges were regulated. Process design varied among countries especially regarding target population, project size, sources of funds for subsidy, and subsidy payout.

Similar solutions are being introduced in lower-income countries with less developed telecommunications networks, including Bolivia, Ghana, Nepal, Nicaragua, and Uganda. It is too early to assess results, but in the design stage the model seems promising there as well. Some countries (e.g. Chile, Colombia) are trying out analogous approaches to support public access to the Internet.

Electricity

Subsidy programs for rural electrification aim at providing electricity for a mix of domestic uses (e.g. lighting, television, radio), productive uses (e.g. water pumping, refrigeration, mills, sewing machines) and public uses (e.g. schools, health centers, police stations). The programs typically aim at making electricity available to individual households, farms, and businesses, not only for community uses.[10]

There are important tradeoffs between service quality and cost. Although power grid standards are ultimately sought, in the absence of well developed networks alternative off-grid solutions are often faster and more flexible to deploy and require lower initial investment, although in some cases they may be more expensive to run.[11] Off-grid solutions can meet typical rural demand patterns in a more flexible way than traditional

solutions, especially to dispersed users in remote areas, at a cost that is comparable to what rural users already spend in inferior energy sources (e.g. candles, kerosene, battery charging, disposable dry cell batteries).[12] Off-grid systems, however, typically provide only limited service duration (e.g. electricity available only a few hours each day in many rural diesel systems), lower voltage stability, or limited power and energy

A growing variety of business models are used to deliver rural electricity. For example, a cluster of consumers may be supplied by a local electricity services company or cooperative using a mini-grid powered by renewable resources and backed up by diesel generation where needed; if demand grows a connection to the main grid may become more cost-effective so that local generation may be discontinued or combined with grid power. Solar home systems may be sold by equipment dealers to households, usually as installed systems, sometimes on credit or with service contracts or guarantees, or may be owned by an energy services company that charges the household a monthly fee and is responsible for the service. Some of these delivery mechanisms are well suited for open competition among firms (e.g. sale of solar home systems) while others typically involve licensing, franchising, and regulation (e.g. village mini-grids and electricity service companies).

Experience using competition among firms for providing subsidized rural electricity service is building up, but it is too early to evaluate fully the results. In Chile, a rural electrification fund established under the auspices of the National Energy Commission receives subsidy resources from central and regional governments. Competition takes place among communities for their projects to be funded, among private operators to do the projects, and among regions to receive the subsidies. Users are required to cover 10 percent of the investment costs (paid in installments) including final connection, meter and in-house wiring. From 1995 to 1999, the government invested $112 million, and the private sector a further $60 million, to install 110,000 new domestic connections. The proportion of private sector financing increased from 53 percent in 1992 to 76 percent in 1999 (Jadresic 2000).[13]

A program started in Argentina in 1995 aims at providing electricity to about 70,000 rural households and 1,100 public service institutions, all in isolated rural areas using mostly off-grid renewable energy sources. Subsidies are paid on completion of connections at a declining rate over time, averaging about $400 per household or about $80 per person. Eight provincial off-grid concessions lasting 15 years are awarded through competitive bids for the lowest subsidies (or through negotiation, depending on market size). Concessionaires are granted exclusivity in exchange for the obligation to meet all demand at prices set by the government before bidding and renegotiated every two years following pre-established rules. Concessionaires will be eligible to rebid competitively when their concessions expire, up to a maximum of 45 years (Reiche et al. 2000).

A program in Cape Verde will grant two concessions to sell off-grid wind or solar electricity systems in rural areas or install such systems and sell the electricity. They may also compete with existing power grid service were available. The concessions are not exclusive, but other providers would not be subsidized. The concessions are being awarded through competitive bids for the lowest subsidies to start up and run the services (Tomkins 2001).

Competition among firms for subsidies is being considered in the design of projects in several other countries (e.g. Bolivia, Morocco, Nicaragua, Senegal, Uganda) with funding from several donors. The Asian Development Bank's energy policy of 2000 advocates determining rural electricity subsidies through competition for the franchises but no cases of application have been reported (ADB 2000).

Water supply

Potable water and, to a lesser extent, sanitation services, are often a priority for rural communities. Willingness to pay for improved services depends on the distance to, and quality of, existing sources of water and sanitation facilities, as well as the consumers' perceptions of the health threats of unimproved services. Solutions to improved water supplies in rural areas are almost always localized, the water supply (be it ground or surface water) and its treatment and distribution being provided in each community as a stand-alone system. Network solutions only make economic sense in areas where water sources are scarce or expensive, or where communities are close to one another. For each water technology there are also service level options, which can range from shared facilities (public stand posts or community hand pumps) to house connections (individual hand pump, yard tap, or in-house plumbing). For sanitation services the choice of technology and service level depends on population size and concentration, water service level and consumption rates, and soil permeability. For most rural areas in developing countries, the appropriate solution will be an on-site sanitation system (latrine or septic tank). Piped sewer and wastewater treatment systems are sometimes installed in larger communities, but costs are high.

After years of struggling to achieve sustainable rural water systems scattered in communities across the rural landscape, most countries have now shifted from centralized supply-driven service provision models to decentralized demand-responsive ones. Rural water systems are often financed and constructed through programs managed by specialized national or regional agencies, and then handed over to be operated and maintained by community-based organizations, such as water committees and cooperatives.[14] Community-based organizations have done well managing the day-to-day operations of simple water and sanitation systems, although they often operate on very tenuous financial grounds and are unable to accumulate savings or develop the technical capacity to undertake major repairs or system expansions. Countries are now looking for new models of sustainable rural water systems, increasingly turning to the private sector to help run existing services through management contracts, leases, and concessions.

There are recent cases of applying competition among firms for subsidized concessions to provide new connections and upgrade existing systems.

In Paraguay the target is to provide piped water service to about 2.0 million people in rural areas, reaching 85 percent population coverage by 2010. During a pilot project, the national agency responsible for service provision (SENASA) invited competitive bids for a 10-year exclusive concession to design, build, and operate water supply systems in four small towns with a combined population of about 12,000. The concessionaire receives a one-time subsidy of $150 per completed connection. Prior to bidding the tariff was fixed at $5.26 per month for unmetered connections and at $3.95 per month for the first 12 m^3 plus $0.53 per additional m^3 for metered connections, subject to periodic adjustments following a formula. Design and service standards (water quality, continuity, pressure) were also set upfront. The concession was awarded to a consortium of construction contractors and a local water system operator that bid to charge the lowest connection fee to users ($62). Three bilateral contracts among SENASA, the communities, and the contractor-operator tie all parties into the project.[15] As of August 2003, two of the four systems had been completed and were in operation.[16] A second tender was under preparation for a larger, multi-community concession in Nanawa, Puerto Falcón, and Beteretecue near Asunción, expected to serve 7,600 users. In this second pilot, the tariff and the connection charges have been agreed in advance with participating communities. The one-time subsidy required by bidders will be used as the bidding variable (Drees et al. 2001).

In Colombia, construction companies are invited to bid for contracts to build and operate water and sewerage systems for 10 to 15 years in about 25 small municipalities with less than 12,000 inhabitants. These contracts are awarded to the bidders that request the lowest one-time subsidy for investment. Investments are expected to be in the range of $0.5-1.0 m per municipality. Subsidies cover about 70 percent of investment, averaging about $300 per connection or $60 per person served. Only municipalities that agree to tariffs meeting at least operating and maintenance costs are eligible to participate. Contracts are signed between the constructor-operator companies and the municipalities,

the latter being responsible for supervision (which may be subcontracted, for example to an external auditor) and enforcement. The proportion of households connected to piped water is expected to increase in 2 to 5 years (varying among municipalities) from less than 60 percent to over 90 percent, and the proportion connected to public sewerage systems from less than 30 percent to over 75 percent (World Bank 2001). A pilot project in the town of Nataga achieved 100 percent water coverage (up from 70 percent), 100 percent sewerage coverage (up from 50 percent), and 24 hours/day continuity of water supply (up from 2 hours/day) within two years of signing the contract.

Transport

Developing country governments for decades, and even today, have been willing to undertake substantial capital investments that are not recovered through user charges for rural transport infrastructure (rural roads, tracks, trails, paths, footbridges, and sometimes waterways and airways) but have been reluctant to likewise subsidize the provision of transportation services using these infrastructures.[17] This has been compounded by the separation between providing and maintaining the infrastructure (usually seen as a responsibility of the government and often supported by international development finance institutions) and owning and operating the vehicles (mostly by the private sector) that actually deliver the transport service. Also, little attention was given until recently to non-motorized and other intermediate means of transport.[18] In contrast, transport service subsidies are pervasive in developed countries and are widely accepted there as being essential to establish rural transport services in poor areas with low density of demand and to maintain a minimum level of service required for social reasons.

The implicit rationale for subsidizing road provision is to reduce the cost of the transport service as needed to meet policy objectives regarding access to markets and services generally. Paving some rural roads in Morocco, for example, was followed by the start of privately operated share-ride taxi services, a significant improvement over the government-run bus service (Levy et al. 1998). However, only certain kinds of intervention (such as a new road or water crossing which opens up a new area to

motorized transport) have a very significant impact on transport costs. Moreover, in poor rural areas only few vehicles are likely in the early years of the intervention. Under these circumstances it may be more effective to subsidize the provision of the service (give an incentive for operators to use poor infrastructure) or, preferably, the demand of the target population (provide funds for poor members of the population to better afford essential transport services). In the former case, careful design and management of the subsidy process are essential to ensure that the objective is achieved; targeting subsidies for low-income users is likely to be an issue (Witkiss et al. 1999). Subsidizing demand is another matter which should be addressed but is not the subject of this paper.

Transport services on rural roads include bus services on fixed routes and timetables, pick-ups and mini-buses offering flexible stopping points and times, trucks for hire, and informal transport (e.g. hitching rides, often for a fee). Rural transport services are provided by both public and private companies and individuals. Companies tend to operate medium-size and large vehicles, which require significant investment and organizational support. Individuals tend to invest in minibuses, pickups, and intermediate means of transportation (including small tractors) (Starkey et al. 2002). There are also services brought to rural communities by vehicles operated by government and parastatal organizations, NGOs, and the private sector. They include delivery of farm inputs to local depots for collection by farmers, crop purchasing services, delivery of consumer goods, agricultural extension and community development services, and delivery of services and supplies to rural health and educational facilities (Barwell 1996).

Rural transport services tend to be unreliable and expensive and often exclude low-income areas. Buses, for example, operate mostly along main roads, far from the smaller villages, and tend to fill up at the start of the journey. In many countries a complex maze of regulation, subsidy, and government intervention in the transport sector overall result in inefficient service, routing, and pricing in rural areas. Informal, and often illegal, passenger services sometimes are more easily available than formal, licensed services. Lack of available credit excludes rural ownership of most types of vehicles for own use or to provide service to others. Transport sector reforms are now underway in some

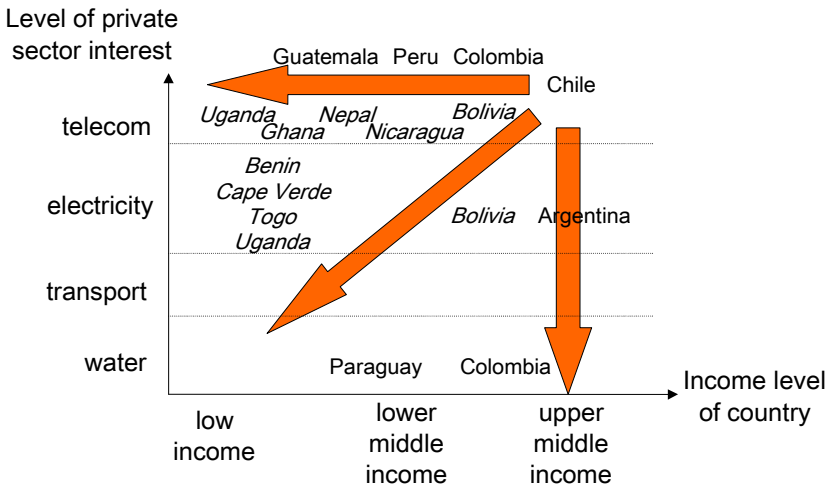
countries to improve the regulatory framework of rural transport services, for example eliminating price and quantity controls and introducing competition to improve service efficiency. Credit schemes are being tried successfully as a way to increase availability of rural transport services.[19]

Competition among operators for subsidies to provide rural transport services has apparently not been attempted in developing countries.[20] There is, however, considerable experience in the use of bidding for route frequencies, fare levels, and subsidies in rural areas of developed countries, as well as in urban areas of developing countries. These experiences may become relevant to rural areas of developing countries with the necessary institutional capacity once the regulatory framework has been set roughly right.[21]

Factors of success

The discussion has illustrated how the model of competing for subsidies has been spreading from the telecommunications sector in an upper-middle income country, to both lower-income countries and less commercially attractive infrastructure sectors. Figure 1 illustrates this process of diffusion. The question arises as to what factors have contributed to the success of the model thus far, and to what extent do these factors carry over to more difficult environments.

Figure 1: Spread of model of competition for subsidy



Note: Countries in italics are planning to use the model. Others already use it.

Table 2 identifies some of the key factors behind the success of the model in rural telecommunications, distinguishing between the demand side, the supply side, and the enabling environment. The extent to which these conditions apply will vary among sectors and countries at different stages of development, thereby affecting the possibility that this approach can be successfully used.

Table 2: Competition among firms for subsidies: critical success factors

Demand factors	Supply factors	Enabling environment
•Limited or no capital contributions are required from users •Subsidies can be easily targeted to poorest users •Users are able and willing to pay for services •Service features are tailored to user needs and preferences •Services have considerable growth potential	•Several firms are qualified to bid for subsidies •Business opportunities are aligned with operators' strategies •Project components are cost-effectively packaged	•Elements of market-oriented legal and regulatory framework are in place •Government has access to stable and reliable sources of subsidy finance •Private investors have access to long term financing •Donors and different tiers of government are able to coordinate financing policies •National infrastructure networks are already relatively developed •Institutional capacity is in place to implement and manage a competitive subsidy mechanism

Demand factors

Several features of the demand for rural infrastructure services that significantly facilitate the adoption of the model described are common in telecommunications and might apply as well in transportation, but are less pervasive in water and electricity. First, the model may be particularly useful when basic demand for service can be satisfied by communal facilities, such as public payphones or buses, in contrast to electricity and (to a lesser extent) water services, where the higher standard of individual household connections is usually sought. The provision of communal facilities avoids the need to seek substantial capital contributions from individual households to cover connection costs and complementary investments within the household (e.g. wiring, plumbing), which usually requires micro-credit facilities with the additional complications that this entails. A further advantage is that communal installations facilitate the targeting of subsidy resources, since more affluent households will automatically tend to self-select out of the communal option preferring to have their own means to access service (phone, truck).[22]

A second feature that facilitates use of the model is that demand is occasional rather than continuous. Operating a communal service (payphone, bus) does not entail the collection of a significant monthly fee from all beneficiary households. Instead, households pay for the service as and when they need it. Prepayment cards can be used to substantially reduce the cost of payphone revenue collection.

Ultimately, however, the applicability of the model will be constrained by the users' willingness to pay at least as much as is required to meet service operation and maintenance costs. This is necessary for the market to be sustainable beyond initial investment and start-up. There is ample evidence that rural households, given the opportunity, spend significant proportions of their monetary incomes in rural infrastructure services (or in inferior alternatives), perhaps 10-20 percent overall.[23] This can suffice to sustain communal facilities, such as payphones, lighting for schools and health centers, water distribution points, and some level of public transport, throughout much of the rural population in many developing countries.[24] For individual household

connections and vehicles, however, much higher income thresholds are likely.[25] Minimum levels of rural household connections to electricity, water supply, and mobile phone networks each typically cost users $5-$10 per month, which probably would be taken up only in areas with per capita rural annual incomes above $300 to $500.[26] Without some level of subsidy, this would exclude most of Sub-Saharan Africa and South Asia and probably extensive regions within Latin American and East Asian countries.[27]

Besides income, other factors influence the demand for rural infrastructure services. These factors include the location, information on options, ease of use and payment, and reliability of communal services, as well as hassle-free connection, low fixed periodic charges, easy control of expenditure, accurate billing, and prompt repair of household connections. Access to the broader service infrastructure is a major factor in some sectors. The value of payphones lies in being able to communicate with others well beyond nearby villages and towns; as call charges become insensitive to distance, long distance and international traffic grows and generates additional revenue from incoming calls (Wellenius 2002). Interconnected bus routes increase potential demand for transport services and enable rural communities to respond to a wider range of market opportunities (Starkey 2002).

Demand growth potential is a major determinant of sustainability. Some companies that provide subsidized rural payphones also offer individual telephone lines and Internet access to homes and small businesses on commercial terms using the subsidized infrastructure at marginal cost (Wellenius 2002). When a private operator takes over a community water system that has public stand posts, there is usually a large latent demand for upgrading to household connections.

Supply factors

On the supply side, the primary concern is having enough qualified providers competing for the subsidies. Competition for subsidies works best when several firms compete for each subsidized project. In such situations the lowest subsidy bid has typically been between one-third and one-half the maximum available. When there is only one bidder for a project, bids have tended to be close to the maximum subsidy available. In that situation, the subsidy awarded is determined by the calculus of costs and benefits used to design the bidding process more than by the market, and errors of calculus become errors of investment.

The number of prospective bidders depends partly on how well the market for infrastructure services has already developed in the country. In Paraguay, besides the public urban water supply company there are about 900 water user associations covering 37 percent of the rural population and some 400 small independent water providers ("aguateros") in peri-urban areas at competitive prices and service quality (Drees et al. 2001). Operating experience can be built up, if necessary, in related firms. In Colombia, water system construction firms are being allowed to bid for service concessions and will receive technical assistance on service management (World Bank 2001). In Morocco and Ghana, franchising by foreign firms has been proposed to address technical weakness of local firms (Colignon et al. 2002). Opposition to foreign private firms taking over water supply can be offset by participation of local companies.

Whether eligible firms actually bid for the subsidies depends on the extent to which the projects offer attractive business opportunities that fit the firms' overall business strategies. The first call for rural electrification tenders in Cape Verde failed due to insufficient subsidies offered to offset high costs and low revenue potential (Tomkins 2002). One of the largest Chilean telecommunications companies, despite the competitive advantage of its countrywide network and substantial presence in rural areas, did not regard rural service as a strategic business interest and never bid for the rural payphone subsidies being offered from 1995 to 2000 (Wellenius 2002). Insufficient

competition may also result from lack of confidence in the regulatory regime, entry limitations still in place from earlier times (e.g. only one electricity distribution company authorized per region), or a process that is effectively competitive in its initial rounds but ends up with providers consolidating their markets on a regional basis.

There is still debate over offering exclusive operating rights to enhance the value of the business opportunity offered in an otherwise pro-competitive market environment. Exclusivity is generally not granted with rural telecommunications subsidies but the practice is mixed in electricity and water supply.[28] Exclusivity, besides running against market-oriented reform principles, is unlikely to add value to concessions or licenses in markets that operators are not prepared to serve on their own. Exclusive rights to subsidy, in contrast, make sense since the objective of the subsidy program is to extend service where none is available rather than promote competition in the market.

How demand is aggregated into projects, and the extent to which this is left to individual bidders, may affect considerably their ability to compete. Bundling the provision of several infrastructure services (e.g. electricity and water) may help spread out costs and attract more bidders.[29] A bidding process that is simple, transparent, expeditious, and not unduly burdensome on the bidders also contributes to attracting bidders.

Enabling environment

Competition among firms for subsidies makes practical sense only in the context of economic reforms that place responsibility for service provision on the private sector, encourages new entry and competition, and ends cross-subsidies. Competition for subsidies among firms is designed to be used to narrow gaps between the market and development needs, not to substitute for the market nor to compensate for regulatory distortions of the market. A clear, stable, and credible legal and regulatory sectoral and general business framework is needed for prospective service providers to make reasonable estimates of costs and revenues and assess the risks they are being asked to assume. The pilot rural water supply tender in Paraguay was suspended at one point for

lack of clarity on what government agency had authority to issue the concessions, until finally a three-way contracting arrangement was agreed. Service providers are especially concerned about the rules and practices on competition, pricing, interconnection, and access to scarce resources within the sector, and on private ownership, foreign exchange, and taxation of businesses in general. They are also worried that their revenue base may be undermined by services provided for free or below cost by international aid programs, NGOs, or local authorities outside the agreed policy framework.

The model also requires access to financing by all key players. A major aspect of qualifying firms to bid for subsidies is their capacity to mobilize equity and debt financing for the components of investment and start-up that are not subsidized. This is not likely to be a problem when schemes are large enough to be attractive to foreign investors, with access to long term finance on the international markets. Smaller scale schemes, however, targeted primarily at local operators, may face difficulties if longer term finance is not available on the domestic capital market.

The government must have in place sustainable sources and transparent mechanisms to collect and disburse the subsidies. Many of the schemes described in this paper are backed by special rural infrastructure funds that are financed either by fiscal transfers or by sector resources. In the telecommunications sector, the revenues usually come from small percentage levies on sector turnover, or sometimes from the proceeds of spectrum or operating license auctions. Funding within the sector in this way can improve the reliability of access to subsidy resources. However, in electricity and (particularly) water, these sector based sources of funding are far less common. Finally, governance of subsidy resources is critical. Even where sector funds are established, there are instances of the resources being diverted to meet more pressing fiscal needs, as occurred for example with the rural telecommunications fund in Bolivia and the rural electricity fund in Argentina.

Subsidies typically cover between 20 percent and 100 percent of investment and start-up costs. The magnitude of subsidy requirements ranges considerably, from $10 per

inhabitant to $200 per inhabitant, according to whether a communal facility (such as a payphone) is provided, or individual household connections are needed (as for water and electricity). Moreover, the ability to leverage private investment with subsidy resources may vary significantly across sectors. Whereas subsidy schemes for rural telephony in Latin America have been able to mobilize between $2 and $6 of private financing for every $1 of government subsidy (see Table 1), subsidy schemes for rural electrification in Argentina and Chile were only able to raise $1 of private financing for every $1 of government subsidy.

Availability of subsidy funds defines the pace of rural service development. In Chile, between 1994 and 1999 access to payphones increased from 10 percent to over 80 percent of the rural population, electricity supply increased from 53 to 76 percent of rural households, and water supply increased from 81 to 93 percent of households in rural communities of at least 150 people, with a total subsidy of about $260 million (less than 0.1 percent of GDP each of the five years) financed from general tax revenue through regional and sectoral development funds.[30] Alternative sources of subsidy funds include levies on similar services in profitable areas, license fees, and international development credits and grants.[31]

The cost and quality of rural services depends on the extent to which related infrastructures are already developed. Least-cost solutions for rural telecommunications mainly comprise extensions to existing fixed and mobile urban and interurban networks while stand-alone solutions, such as VSATs, are much more expensive to install and run. Off-grid electricity supply can be a temporary solution for users living near existing grids; interconnection to the power grid potentially enables lower operating costs, higher quality standards, flexibility to meet unexpected demand, competitive purchase of energy from different generators, and reduced environmental impact. Feeder roads and transport hubs (markets, village terminals) are needed for buses and trucks to consolidate and distribute passengers and freight; interconnected routes reduce the risk of poor load factors, increase traffic volume, and encourage competition among service operators (Starkey et al. 2002).

A key challenge in implementing rural infrastructure delivery models based on competition for subsidy is coordinating strategies between donors and different tiers of government. A concession of a private operator, premised on a partial investment subsidy and a financially self-sustaining operation over the medium-term, would be destroyed if within a couple of years a local municipality or NGO started to offer people a free service in the same geographic area, or if a provincial government suddenly decided to give a subsidy to extend the grid into an area that had been earmarked for subsidized extension of solar home systems. The telecommunications sector has limited exposure to these problems given that it is typically organized at the national level with little history of local government involvement, and relatively limited activity by donors and NGOs. In water and electricity, however, the situation is far more complex with a wide range of actors participating in the financing and implementation of rural projects, making it more difficult to achieve the necessary degree of coordination over the medium term.

Institutional capacity is needed to set up and run a competitive subsidy system for rural infrastructure services. This includes originating and shepherding specific legislation and regulations, setting up and managing the financing mechanisms, designing and implementing the bidding processes, monitoring service development, and enforcing service commitments. In countries with well established public administration traditions, a well-designed program of competition among firms for rural subsidies can be implemented by a rather small team of professional and support personnel.

Lastly, long term sustainability of the model will depend on how well and realistically the risks have been apportioned among the players and the extent to which commitments can be enforced. Since subsidies are paid early in the project life cycle, should expected revenue streams later fail to materialize the operator may face a sustained negative cash flow and prefer to close down. Service obligations and penalties for non-compliance may deter such behavior in some cases. One rural electricity company in Chile maintained service to distant households despite recurrent losses only in order to avoid fines. But in Bolivia, some rural communities surveyed complained that they had no recourse against

the rising cost and poor quality of electricity service. Ultimately, even if construction and commercial risks are initially assumed entirely by the private operators, if they fail the government may have no choice but to step in and take measures to maintain service, since that was its objective in the first place.[32]

Conclusions

There is good potential for using competition among firms for rural service subsidies in lower-income countries and for a number of different rural infrastructure services. Compared with traditional public sector infrastructure funding, this mobilizes private investment, reduces government outlays to meet given policy objectives, promotes cost-effective solutions and the emergence of new entrepreneurs, and enhances transparency.

The model, however, does not offer a means for rural services to outrun overall economic development. Irrespective of overall development, the model is likely to be easier to apply in some sectors than in others. Users must be able and willing to generate sufficient revenues to sustain commercial provision of the services beyond initial investment and startup. Governments must be able and willing to allocate resources for initial subsidy. These conditions limit the level of services that can be expected and the pace at which they may be extended to new population groups. Moreover, the model is useful only to complement the market, not replace it. Some progress in economic reform, market development, access to financing, and overall infrastructure development is therefore necessary before the model can be applied. Governments must have in place the institutional capacity to set realistic targets, design and manage the subsidy programs, supervise their implementation, enforce decisions, and assume some risk.

Whether these conditions are in place can only be assessed case by case. A simple classification of countries and sectors cannot do justice to the complexity of the issues. But individual situations can be examined initially by reference to the factors identified in this paper.

Notes

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[1] Subsidies often resulted from the governments' unwillingness to increase sensitive prices in line with rising costs, political compromising among major interest groups, inadequate accounting of costs, or other reasons mostly unrelated to specific economic or social objectives. Monopoly rents were used to provide cross-subsidies among services, classes of customers, and geographical areas. Government subsidies to service providers included grants, fuel and energy sales below cost, access to concessional credit and rationed foreign exchange, and exemptions from taxes and duties.

[2] Private consumption of services that exhibit positive consumption externalities is likely to fall below the socially optimal level. For example, households without water and sanitation services are more likely to become ill, disease is then transmitted to other families, and the cost is partly borne by the public health services. In the case of communication services, when new users are connected to a network (e.g. telephone, television) this also benefits other participants that now can communicate with them. Due to scale economies resulting from high initial investment and start-up costs, the prices that make investments privately profitable in the early stages of market development can be much higher than the marginal cost of production (or may not even exist), thus leading to investment levels well below socially optimal levels. Infrastructure services, as much as education, medical care, food, and housing, are considered necessary for life, not merely consumption choices (Serra 2000).

[3] This is a position on economic policy as much as a reflection of the practical observation that projects that rely on continued subsidies are unduly vulnerable to the availability of public funds or aid.

[4] A standard technique is to identify projects with positive social NPV (present value of benefits net of costs) and negative private NPV. Projects meeting these conditions can be ranked by social NPV per unit of maximum subsidy to be made available. Ranking this way maximizes the social return per dollar of subsidy but helps the worst-off localities last.

[5] The situation is somewhat different in transition economies, where telephone penetrations inherited from the days of central economic planning are much greater but unrelated to market realities. The issue there is to provide some protection to rural and low-income urban telephone customers already connected but unable to pay commercial prices.

[6] Despite major progress in recent years, on average only about 30 percent of households have a phone (ranging from around one percent in parts of sub-Saharan Africa to over 70 percent in some Latin American countries), almost all in the main urban areas.

[7] In 2003 about one-half of all low-income countries had more mobile than fixed phones, and the proportion is rising.

[8] Monetary units throughout this paper are current US dollars.

[9] In Chile, installing payphones to reach roughly the first half of the excluded rural population required subsidies of only $1,200 per village or $3 per person. Halving again the unserved population tripled the subsidies. In the last round, benefiting only two percent of the initial unserved population, subsidies reached almost $13,000 per location or $45 per person. See Wellenius 2002.

[10] On average about one-third of all households in developing countries have electricity. This compares with a similar average for fixed telephones. Subsidy programs, however, generally aim at individual household connections to electricity but only communal access to telephones. This difference in target level of service goes a long way toward explaining the higher subsidy per capita needed for rural electrification projects.

[11] Off-grid power may be produced using diesel, photovoltaic (solar), wind, biomass, or small hydroelectric generators or combinations of these (hybrid systems), and delivered through village mini-grids to tens or hundreds of users or through isolated systems serving one or two users.

[12] A typical solar home system with 50 WattPeak generation and a battery is enough to light a few small bulbs, a radio, and a small television set.

[13] Although the program is technologically neutral covering grid extensions, mini-grids, and dispersed systems, in practice most projects financed have been grid extensions.

[14] In addition, recent decentralization reforms have transferred legal responsibilities for service provision from national to local governments. This, however, has left many countries with unclear, and often contradictory, legal frameworks for defining ownership, rights, and responsibilities between communities and local governments.
[15] A construction contract between SENASA and the contractor-operator covers design, construction, and conditions for disbursement of the subsidy. A contract with SENASA commits each community to participate in the pilot and manage a service contract. A service contract between each community and the contractor-operator (a) defines the service area and water service quality standards, (b) establishes fees and tariffs and a standard formula for their adjustment, and (c) establishes terms of compensation in case of early contract termination.
[16] In order to accelerate roll-out, the contractor-operator offered low-income households that helped construct the system water vouchers (that could be used towards connection charges and monthly water bills) and free water consumption during the initial trial period.
[17] Reluctance to subsidize rural transport services in developing countries reflects (a) market orientation of economic reforms, (b) preference for lasting investments in infrastructure, (c) difficulty allocating responsibility and budgets for subsidy programs among levels of government, (d) the perception that rural transport is relatively unimportant for work and that informal alternatives may be available, (e) high cost of tendering, monitoring, and enforcing rural concessions relative to total project cost, and (f) limited institutional capacity at lower government levels (e.g. municipalities) to carry out these tasks.
[18] Intermediate means of transport fall somewhere between walking and using conventional motor vehicles for personal, small business, and agricultural transport. They include pack and draft animals, animal-drawn carts, wheelbarrows and handcarts, bicycles, cycle trailers and tricycles, motorcycles, and tractors.
[19] Additional information can be found at the World Bank's website on rural transport services at www.worldbank.org/transport/rural_tr/rts_imt.htm
[20] Although the idea has been discussed in some developing countries, the authors are not aware of any results so far. Indirectly, though, privatization of state-owned transportation enterprises through competitive tenders in some countries may have provided subsidies to new rural operators, for example through below-cost sale of assets or initial tax exemptions. Also, where the construction or maintenance of infrastructure is undertaken by the private sector, the work is usually contracted through a tendering process which encourages competition for the price to be paid, including any element of subsidy. Such competition is being extended to various forms of BOOT (build, own, operate, and transfer) contracts (e.g.. South Africa).
[21] For example, several rural routes could be licensed together and groups of operators encouraged to form companies to bid for these licenses, which would be awarded to the company that requires the lowest subsidy. Route frequencies, fares, and subsidy amounts would be made explicit in the bidding process. See Starkey et al. 2002.
[22] Whether this proves to be a concern (or a business opportunity) will depend on the economic homogeneity of the target population. In small rural settlements it is typical for most inhabitants to be living close to or under the poverty line so this may be unimportant.
[23] About 2-3 percent of community income is often used for initial analysis of rural telecommunications programs. Surveys of rural communities in countries as different as Argentina, India, Nicaragua, and the Philippines show that households spend about five percent of monetary income in energy, fairly consistently across countries and with even higher proportions for the lower income households. The World Health Organization's target is that water supply should not cost more than five percent of household income.
[24] An initial analysis of population incomes and system costs suggested that in the mid-1990s a payphone could be commercially viable in a community of at least 220 rural inhabitants in Indonesia, 480 in Bolivia, 690 in Kenya, and 920 in Nepal. See Kayani et al. 1997.
[25] Electricity supply to power four 10-watt light bulbs and a television set for a few hours every day is a target that can be met in many rural homes in Africa, while national grid standards could not be sustained without permanent subsidies. Installing payphones within easy reach of most rural people in less than 10 years is a feasible objective in the Philippines as much as it was in Chile, whereas providing phones in most individual rural households, farms, or small businesses is not.
[26] For example, $5 per month of water assuming the WHO target of five percent of household income and five persons per household implies an annual per capita income of $240. Five dollars of pre-paid mobile

phone, assuming two percent of household income spent on this service and five persons per household, implies an annual per capita income of $600.

[27] India, Pakistan, and eighty percent of sub-Sahara African countries have GDP below $500.

[28] For a summary of the argument in favor of exclusivity in rural electricity see Reiche et al. 2000.

[29] Combining rural infrastructure projects of different sectors can reduce total government costs (e.g. demand surveys, road shows, supervision) and supply costs (especially operation and maintenance). Having several projects focus on the same geographical areas first may increase development impact.

[30] The targets set in 1994 were 100 percent of households with electricity by 2005 and 98 percent of households with water supply by 2000. See Wellenius 2002, Jadresic 2000, and Serra 2000.

[31] Since rural services are expected to benefit society at large, subsidies should preferably be funded from general tax revenue through national or regional government budget allocations over multiple years as needed to reach service targets. As second best, subsidies are sometimes financed by mandatory contributions from profitable provision of similar services in other parts of the country; this is common in telecommunications. Key considerations for designing a mechanism to collect, allocate, and disburse these funds are simplicity and transparency, stability during the implementation period, and cost-effectiveness. Typically the cost of administering subsidies does not exceed a few percent of the monies being handled. For a discussion of financing sources and mechanisms in the telecommunications sector see Wellenius 2000.

[32] In Chile, one of the new rural telecommunications companies in the long run was unable to build up its business as expected and eventually negotiated with another company to take over its customers and service commitments. The experience with pilot telecenters, for which running costs are more important than investment and startup costs, has been less satisfactory.

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